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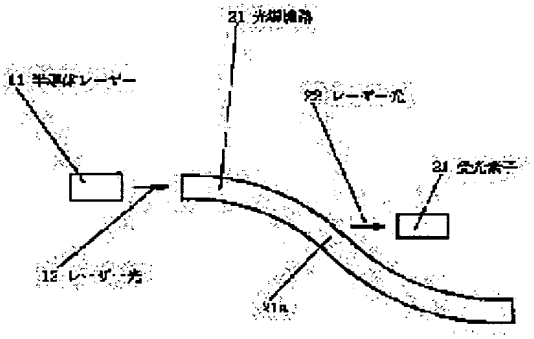
(54) OPTICAL TRANSMISSION DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain an optical transmission device having a relatively simple constitution eliminating the necessity of having a directional coupler and an optical phase shifter and an optical tap and/or an ADD functions are realized.
SOLUTION: The optical transmission device consists of an optical transmission line 21 having a bent section 21a and at least one of a light receiving element 31, which is provided in the vicinity of or contacting to the section 21a and receives light beams 22 that are leaked from the section 21a, or a light emitting element which is located in the vicinity of the section 21a or contacting to the section 21a and introduces light beams to the line 21. A radiation mode exists at the section 21a of the line 21 and the light beams are received by the element 31. The light beams radiated from the light emitting element are coupled to the line 21 through the section 21a of the line 21.



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CLAIMS

[Claim(s)]
[Claim 1] The optical transmission device characterized by consisting of at least one side of the light emitting device which approaches or contacts, is prepared in the photo detector and this flection which receive an optical transmission line with a flection, and the light which it approaches or contacts, is prepared in the flection of said optical transmission line, and is leaked from this flection, and introduces light to said optical transmission line through this flection.
[Claim 2] The optical transmission device according to claim 1 characterized by accumulating at least one side of said optical transmission line and said photo detector, and light emitting device on the same substrate.
[Claim 3] The optical transmission device according to claim 1 or 2 characterized by having a wavelength selection optical filter between the flections and said photo detectors of said optical transmission line.
[Claim 4] The optical transmission device according to claim 3 characterized by accumulating said optical transmission line, said photo detector, and said wavelength selection optical filter.
[Claim 5] The optical transmission device according to claim 1 or 2 characterized by equipping with a diffraction grating the part in which the flection of said optical transmission line faced said photo detector.
[Claim 6] The optical transmission device according to claim 5 characterized by accumulating the optical transmission line equipped with said diffraction grating, and said photo detector.
[Claim 7] Said optical transmission line is an optical transmission device given in claim 1 thru/or any of 6 they are. [which is characterized by consisting of optical fibers arranged all over a slot with a flection]
[Claim 8] The optical transmission device according to claim 7 characterized by accumulating at least one side of a slot with said flection, said photo detector, and a light emitting device.
[Claim 9] The optical transmission device according to claim 7 or 8 characterized by having a wavelength selection optical filter between the flections and said photo detectors of said slot.
[Claim 10] The optical transmission device according to claim 9 characterized by accumulating said slot, said photo detector, and said wavelength selection optical filter.
[Claim 11] The optical transmission device according to claim 7 or 8 characterized by forming a diffraction grating in the part by the side of the photo detector of the flection of said slot.
[Claim 12] The optical transmission device according to claim 11 characterized by accumulating a slot with said diffraction grating, and said photo detector.
[Claim 13] The optical transmission device according to claim 7 or 8 characterized by forming a diffraction grating in the part located in the part by the side of the photo detector of the flection of said slot among said optical fibers.
[Claim 14] The optical transmission device according to claim 13 characterized by accumulating said slot and said photo detector.

[Claim 15] Said optical fiber is an optical transmission device given in claim 7 thru/or any of 14 they are. [which is characterized by having a rectangle cross section]
[Claim 16] Said optical fiber is an optical transmission device given in claim 7 thru/or any of 15 they are. [which is characterized by being a plastic optical fiber]
[Claim 17] Said optical transmission line is an optical transmission device given in claim 1 thru/or any of 6 they are. [which is characterized by consisting of channel mold optical waveguide]
[Claim 18] Said light emitting device is an optical transmission device given in claim 5, claim 6 and claim 11 thru/or any of 17 they are. [which is characterized by being arranged so that light may be put into an optical transmission line from the part of the opposite side of the part of an optical transmission line equipped with a diffraction grating]
[Claim 19] Said flection is an optical transmission device given in claim 1 thru/or any of 18 they are. [which is characterized by being the bend at which it has turned smoothly]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical transmission device which gave DROP or/and the ADD function of light using optical transmission lines with a flection, such as an optical fiber and channel mold optical waveguide.
[0002]
[Description of the Prior Art] Conventionally, optic fiber communication is already put in practical use by the long-distance trunk system, and a plan to lay an optical fiber from a relay center to office or a home from now on is progressing. And aiming at the inside of office and domestic realizing optical fiber transmission, research is further advanced with the increment in amount of information. It is thought that the optical tap (DROP function) which pulls out a part of signal light from the main transmission line especially if needed, and the ADD function to add signal light to the main transmission line if needed increase importance when building the Local Area Network which used the optical-communication circuit. As well-known reference about this, there is JP,5-2155,A, for example.
[0003]
[Problem(s) to be Solved by the Invention] However, as for the conventional optical tap, at least a directional coupler and light needed the comparatively complicated configuration of a phase shifter (in order to perform a tap by the flux of light interference principle, needed all over a fork road or the main transmission line) etc.
[0004] Therefore, the purpose of this invention offers the optical transmission device which has a comparatively easy configuration with a as unnecessary phase shifter etc. as a directional coupler or light, and can realize an optical tap or/and an ADD function.
[0005]

[Means for Solving the Problem and its Function] The optical transmission device of this invention for attaining the above-mentioned purpose is characterized by consisting of at least one side of the light emitting device which approaches or contacts, is prepared in the photo detector and this flection which receive an optical transmission line with a flection, and the light which it approaches or contacts, is prepared in the flection of said optical transmission line, and is leaked from this flection, and introduces light to said optical transmission line through this flection. In this configuration, it operates as an optical tap by radiation mode existing by the flection of an optical transmission line, and receiving this light by the photo detector. Moreover, the light emitted from the light emitting device combines with an optical transmission line through the flection of an optical transmission line. Consequently, an ADD function is realized. Both an optical tap function and an ADD function can also be constituted in the appearance to give, and can give only either.

[0006] Based on the above-mentioned basic configuration, the following more concrete configurations are possible. At least one side of said optical transmission line and said photo detector, and light emitting device is accumulated on the same substrate. In this configuration, the physical relationship of an optical transmission line and a photo detector is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light. Moreover, the physical relationship of an optical transmission line and a light emitting device is stabilized, consequently the ADD function that the joint effectiveness of light is fixed is realized.

[0007] It has the wavelength selection optical filter between the flections and said photo detectors of said optical transmission line. In this configuration, radiation mode exists by the flection of an optical transmission line, the lightwave signal of specific wavelength is chosen out of this synchrotron orbital radiation with a wavelength selection optical filter, and it operates as an optical tap also by the time of wavelength multiplex transmission by receiving this by the photo detector.

[0008] Said optical transmission line, said photo detector, and said wavelength selection optical filter are accumulated. In this configuration, the physical relationship of an optical transmission line, a photo detector, and a wavelength selection optical filter is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light also in the time of wavelength multiplex transmission.

[0009] The flection of said optical transmission line equips with the diffraction grating the part which faced said photo detector. In this configuration, as for synchrotron orbital radiation, an angle of diffraction changes with those wavelength by the diffraction grating of a flection. Consequently, the lightwave signal of specific wavelength can be received by the photo detector out of synchrotron orbital radiation, and it operates as an optical tap also in the time of wavelength multiplex transmission.

[0010] The optical transmission line equipped with said diffraction grating and said photo detector are accumulated. In this configuration, the physical relationship of the optical transmission line equipped with the diffraction grating and a photo detector is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light also in the time of wavelength multiplex transmission.

[0011] Said optical transmission line consists of optical fibers arranged all over a slot with a flection. In this configuration, radiation mode exists in the optical fiber arranged to the flection of a slot, and it operates as an optical tap by receiving this light by the photo detector. Moreover, an ADD function is realizable by introducing light by the light emitting device through the flection of an optical fiber.

[0012] At least one side of a slot with said flection, said photo detector, and a light emitting device is accumulated. In this configuration, the physical relationship of an optical fiber and a photo detector is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light. Moreover, an ADD function is realizable, where the physical relationship of an optical fiber and a light emitting device was stabilized, consequently the joint effectiveness of light is kept constant.

[0013] It has the wavelength selection optical filter between the flections and said photo detectors of said slot. In this configuration, it operates as an optical tap also by the time of

wavelength multiplex transmission by choosing the lightwave signal of specific wavelength out of synchrotron orbital radiation, and receiving this by the photo detector with a wavelength selection optical filter.
[0014] Said slot, said photo detector, and said wavelength selection optical filter are accumulated. In this configuration, the physical relationship of an optical fiber, a photo detector, and a wavelength selection optical filter is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light also in the time of wavelength multiplex transmission.
[0015] The diffraction grating is formed in the part by the side of the photo detector of the flection of said slot. In this configuration, as for the light emitted from the optical fiber arranged at the flection of a slot for the diffraction grating which exists in the flection of a slot, an angle of diffraction changes with those wavelength. Consequently, the lightwave signal of specific wavelength can be received by the photo detector out of synchrotron orbital radiation, and it operates as an optical tap also in the time of wavelength multiplex transmission.
[0016] The slot with said diffraction grating and said photo detector are accumulated. In this configuration, the physical relationship of an optical fiber and a photo detector is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light also in the time of wavelength multiplex transmission.
[0017] The diffraction grating is formed in the part located in the part by the side of the photo detector of the flection of said slot among said optical fibers. In this configuration, as for the light emitted from the optical fiber arranged at the flection of a slot for the diffraction grating with which the optical fiber which exists in a flection was equipped, an angle of diffraction changes with those wavelength. Consequently, the lightwave signal of specific wavelength can be received by the photo detector out of synchrotron orbital radiation, and it operates as an optical tap also in the time of wavelength multiplex transmission.
[0018] Said slot and said photo detector are accumulated. In this configuration, the physical relationship of an optical fiber and a photo detector is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light also in the time of wavelength multiplex transmission.
[0019] If the optical fiber arranged in said slot has a rectangle cross section, it will insert in a slot exactly, will become easy to set it, and it will become easy to make good an optical tap function and/or an ADD function.
[0020] It is easy to form the plastic optical fiber (for vocabulary called a plastic optical fiber to be used to the silica glass fiber in this specification in the sense of the optical fiber which plastic deformation of a polymer, synthetic resin, etc. is possible, and is optically made of the transparent optical material) which is easy to treat said optical fiber, then an optical transmission line with a flection.
[0021] Said optical transmission line may be formed from channel mold optical waveguide, and this is easily formed on a substrate.
[0022]
[Embodiment of the Invention] (The 1st example) Drawing 1 is a drawing which expresses the description of the 1st example of this invention best, and, as for the optical transmission line in which the semiconductor laser (end-face luminescence semiconductor laser etc.) whose 11 is the signal light source, and 12 have the outgoing radiation light from semiconductor laser 11, and 21 has bend 21a in this drawing, and 22, the outgoing radiation light from bend 21a of an optical transmission line 21 and 31 are photo detectors (a pin photodiode, avalanche photodiode, etc.).
[0023] Although bend 21a is a smooth flection with curvature in this example, you may be the flection at which it turns in discontinuous with an include angle in polygonal line. What is necessary is in short, just to decide the refractive-index difference of optical transmission lines, such as optical waveguide, and the exterior of those etc. whenever [curvature and polygonal-line target angle] according to how (branching ratio etc.) to give off the outgoing radiation light 22. Moreover, in this example, optical transmission lines 21 may be what kind of light guides, such as optical fibers (thing of a quartz system and a plastics system etc.) with the thing of a channel mold optical waveguide mold, and a clad. Here, the optical transmission line 21 with covering is held in a configuration like drawing 1 by a certain supporter material (for example, optical

waveguide 21 is put on the plate-like substrate), covering of the part of bend 21a which faces a photo detector 31 is removed, and the window part for outgoing radiation light (un-illustrating) is formed. Although what is necessary is just to opt for arrangement of a photo detector 31 from the point of the light-receiving effectiveness, it is good to be arranged so that it may ride in general on the production of the waveguide of bend 21a of the upstream near bend 21a or in contact with this. Although a flection is in two places of an optical transmission line 21 in the example of illustration so that the input control port and output of an optical transmission line 21 may be located in a line in the almost same direction, of course, there should just be a place.

[0024] In the above-mentioned configuration, if a current is poured into semiconductor laser 11, outgoing radiation of the laser light 12 will be carried out, and it will carry out incidence to an optical transmission line 21 from an end face. A part of laser light 12 which spread the optical transmission line 21 is emitted by partial 21a which has curvature among optical transmission lines. By receiving this emitted laser light 22 by the photo detector 31, the structure of this example operates as an optical tap.

[0025] In addition, the cross-section configurations of an optical transmission line may be whatever, such as not only a circle but a rectangle, a triangle, etc. Especially the size of a cross section is not restricted, either. The above-mentioned dielectric waveguide in which an optical transmission line 21 also contains an optical fiber, or semiconductor waveguide may be anything like.

[0026] (The 2nd example) Drawing 2 (a) and (b) are drawings which express the description of the 2nd example of this invention best, and optical waveguide 121 and a photo detector 131 are integrated by same substrate top 100 in this drawing. In drawing 2 , the number which added 100 to the number of drawing 1 shows the same element as substantially as the element of drawing 1 .

[0027] The producing method For example, after carrying out the laminating of the ingredient 101 surrounding the perimeter of optical waveguide 121 and a photo detector 131 on a substrate 100, Form a mask with a desired pattern, and etch only an optical waveguide part and the laminated structure of optical waveguide 121 is formed using the mask same there. Furthermore, similarly the laminated structure (for example, pin photodiode structure) is formed only in a photo detector part after that using a desired mask (refer to A-A' drawing 2 which is the sectional view of drawing 2 (a) (b)). In this case, optical waveguides 121 may be the strip mold exposed, of course although explained like, rib or ridge mold which is an embedding strip mold, a loading strip mold, etc.

[0028] The actuation in the above-mentioned configuration is the same as the 1st example. At this time, the physical relationship of optical waveguide 121 and a photo detector 131 is stabilized, consequently the joint effectiveness of light becomes fixed still more stably.

[0029] (The 3rd example) Drawing 3 is a drawing which expresses the description of the 3rd example of this invention best, and, as for two or more semiconductor laser with which the wavelength whose 211 is the signal light source differs, and 212, the outgoing radiation light from semiconductor laser 211 and 241 are wavelength selection optical filters, such as the Fabry Perot etalon, in this drawing. In addition, in drawing 3 , the number which added 200 to the number of drawing 1 shows the same element as substantially as the element of drawing 1 .

[0030] In this configuration, if a current is poured into semiconductor laser 211, outgoing radiation of two or more laser light 212 from which wavelength differs will be carried out, and they will carry out incidence to optical waveguide 221. A part of laser light 212 222 which spread optical waveguide 221 is emitted by partial 221a which has curvature among optical waveguides 221. It operates as an optical tap also by the time of wavelength multiplex transmission by choosing the lightwave signal of specific wavelength out of this synchrotron orbital radiation 222, and receiving selection light by the photo detector 231 with the wavelength selection optical filter 241.

[0031] What is necessary is just to receive each by each photo detector to choose two or more wavelength, as it comes out in the location where wavelength which is different, using the etalon of a diffraction grating (refer to the below-mentioned example) and a wedge action die etc. as a filter differs. Moreover, if a filter is a wavelength adjustable thing, wavelength which receives light

will be made to adjustable. Other points are the same as the 1st example.
[0032] (The 4th example) Drawing 4 (a) and (b) are drawings which express the description of the 4th example of this invention best, and optical waveguide 321, the photo detector 331, and the wavelength selection optical filter 341 are integrated in this drawing. In addition, in drawing 4 R> 4, the number which added 200 to the number of drawing 2 shows the same element as substantially as the element of drawing 2 .
[0033] In this configuration, if a current is poured into semiconductor laser 311, outgoing radiation of two or more laser light 312 from which wavelength differs will be carried out, and they will carry out incidence to optical waveguide 321. A part of laser light 312 322 which spread optical waveguide 321 is emitted by partial 321a which has curvature among optical waveguides 321. It operates as an optical tap also by the time of wavelength multiplex transmission by choosing the lightwave signal of specific wavelength out of this synchrotron orbital radiation 322, and winning popularity by the photo detector 331 with the wavelength selection optical filter 341. At this time, the physical relationship of optical waveguide 321, the wavelength selection optical filter 341, and a photo detector 331 is stabilized, and the joint effectiveness of light becomes fixed.
[0034] What is necessary is just to perform production of this configuration according to the producing method explained in the 2nd example (refer to B-B' drawing 4 which is the sectional view of drawing 4 (a) (b)). The wavelength selection optical filter 341 is in this case, like the air layer which used as the reflective film both sides which only etch and are formed, for example. Other points are the same as the above-mentioned example according to the corresponding range.
[0035] (The 5th example) Optical waveguides, such as an optical fiber with which, as for two or more semiconductor laser with which the wavelength whose drawing 5 is drawings which express the description of the 5th example of this invention best, and whose 411 is the signal light source differs, and 412, the flection 421a was equipped with the outgoing radiation light from semiconductor laser 411 in this drawing, and 421 was equipped with the diffraction grating 451, the laser light to which 422 is emitted from optical waveguide 421, and 431 are array photo detectors which consist of two or more components. In addition, in drawing 5 , the number which added 400 to the number of drawing 1 shows the same element as substantially as the element of drawing 1 .
[0036] The diffraction grating 451 is formed in the side face of flection 421a facing the array photo detector 431. The production is easily performed using the 2 flux-of-light interference exposing method. What is necessary is just to set up suitably the direction of the stripe slot of a diffraction grating 451 according to the direction of the diffracted light for which does not necessarily restrict in this direction and it asks although drawn like which is a space perpendicular direction in the example of illustration. With regards to the rate of the laser light 422 emitted, if it becomes deep, the burst size of the stripe depth of flute will increase. The component which has a lens operation between a diffraction grating 451 and the array photo detector 431 is arranged, and you may make it lead the diffracted light to the array photo detector 431 efficiently.
[0037] In this configuration, if a current is poured into semiconductor laser 411, outgoing radiation of two or more laser light 412 from which wavelength differs will be carried out, and they will carry out incidence to optical waveguide 421. A part of laser light 412 422 which spread optical waveguide 421 is emitted by partial 421a which has curvature among optical waveguides 421. By the diffraction grating 451 with which optical waveguide 421 equipped flection 421a, as for this synchrotron orbital radiation 422, an angle of diffraction changes with those wavelength. Consequently, the array photo detector 431 can receive the lightwave signal of specific wavelength with the component of a specific part, and operates as an optical tap also in the time of wavelength multiplex transmission.
[0038] In addition, if optical waveguide 421 has a rectangle cross section and forms a diffraction grating in the side face, production of a diffraction grating becomes easier, and it will become easy to carry out a setup of the diffraction direction, and the design of the direction of an array of the array photo detector 431 etc. will become easy. Other points are the same as the above-

mentioned example according to the corresponding range.
[0039] (The 6th example) Drawing 6 is a drawing which expresses the description of the 6th example of this invention best, and optical waveguide 521 and the array photo detector 531 are integrated on the same substrate 500 in this drawing. In addition, in drawing 6 , the number which added 200 to the number of drawing 4 shows the same element as substantially as the element of drawing 4 .
[0040] What is necessary is just to perform the method of producing this configuration according to what was explained in the 2nd example. In this case, a diffraction grating 551 forms a resist pattern like the optical waveguide pattern of drawing 6 , and should just form it by etching. Other points are the same as the 5th example. The physical relationship of optical waveguide 521 and a photo detector 531 is stabilized by this example, and it becomes fixed [the joint effectiveness of light].
[0041] (The 7th example) Drawing 7 (a) and (b) are drawings which express the description of the 7th example of this invention best, and a slot with flection 602a formed in the laminated structure 601 by which the laminating of 602 was carried out on the substrate 600, and 621 are optical fibers which were dedicated all over the slot 602, for example, have a circular cross section in this drawing.
[0042] In this configuration, if a current is poured into semiconductor laser 611, outgoing radiation of the laser light 612 will be carried out, and it will carry out incidence to an optical fiber 621. And a part of laser light 612 622 which spread the optical fiber 621 is emitted from partial 621a arranged among optical fibers 621 at flection 602a of a slot 602. By receiving this laser light 622 by the photo detector 631, it operates as an optical tap.
[0043] What is necessary is just to perform the method of producing this configuration according to what was explained in the 2nd example (refer to C-C' drawing 7 which is the sectional view of drawing 7 (a) (b)). An optical fiber 621 is [like] good to be settled [to which synchrotron orbital radiation 622 is efficiently led to a photo detector 631] exactly that there is no clearance all over a slot 602 as possible. The optical fiber of a rectangle cross section is convenient if it says from this viewpoint. Although the photo detector 631 is drawn as it integrates, what was produced separately, of course may be installed in the position on a substrate 600. Other points are the same as the 1st and 2nd example. The physical relationship of optical waveguide 621 and a photo detector 631 is stabilized by this example, and it becomes fixed [the joint effectiveness of light].
[0044] (The 8th example) Drawing 8 is a drawing which expresses the description of the 8th example of this invention best, and it has the wavelength selection optical filter 741 between flection 702a of a slot 702, and a photo detector 731 in this drawing. This example combines the example of drawing 4 , and the example of drawing 7 . What is necessary is just to perform production according to the method of producing these examples. In addition, in drawing 8 , the number which added 100 to the number of drawing 7 shows the same element as substantially as the element of drawing 7 .
[0045] In this configuration, radiation mode 722 exists in the optical fiber 721 arranged to partial 702a with the curvature of a slot 702, and the lightwave signal of specific wavelength is chosen out of this synchrotron orbital radiation 722 with the wavelength selection optical filter 741. By receiving a selected light by the photo detector 731, it operates as an optical tap also in the time of wavelength multiplex transmission.
[0046] Although the wavelength selection optical filter 741 and the photo detector 731 are drawn as it integrates, what was produced separately, of course may be installed in the position on a substrate 700. Other points are the same as the 4th example and the 7th example. The physical relationship of optical waveguide 721 and a photo detector 731 is stabilized by this example, and it becomes fixed [the joint effectiveness of light].
[0047] (The 9th example) Drawing 9 is a drawing which expresses the description of the 9th example of this invention best, and 802 is the slot where flection 802a was equipped with the diffraction grating 851 in this drawing. Although drawn on the appearance which has a clearance between a slot 802 and an optical fiber 821 in drawing 9 , this was only written to intelligible appearance on illustration, and has fitted in exactly in fact. In this case, since the cross section

of a slot 802 is a rectangle, it is suitable also for the cross section of an optical fiber 821 that it is a rectangle.
[0048] In this configuration, as for the light 822 emitted from flection 821a of the optical fiber 821 arranged at flection 802a of a slot 802 for the diffraction grating 851 which exists in flection 802a of a slot 802, an angle of diffraction changes with those wavelength. Consequently, the lightwave signal of specific wavelength can be received by the specific part in the array photo detector 831 out of synchrotron orbital radiation 822, and it operates as an optical tap also in the time of wavelength multiplex transmission.
[0049] Although the slot 802 and the array photo detector 831 are drawn as it integrates, what was produced separately, of course may be installed in the position on a substrate 800. Other points are the same as the 6th example and the 8th example. The physical relationship of this example or an optical fiber 821, and a photo detector 831 is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light also in the time of wavelength multiplex transmission.
[0050] (The 10th example) Drawing 10 is a drawing which expresses the description of the 10th example of this invention best, and the optical fiber which equipped with the diffraction grating 951 part 921a to which 921 is located in flection 902a of a slot 902, and 922 are laser light in this drawing. Although drawn on the appearance to which this example also has a clearance between a slot 902 and an optical fiber 921 in drawing 10 , this was only written to intelligible appearance on illustration, and has fitted in exactly in fact. Since the cross section of a slot 902 is a rectangle also in this case, it is suitable also for the cross section of an optical fiber 921 that it is a rectangle.
[0051] In this configuration, as for the light 922 emitted from the optical fiber 921 for the diffraction grating 951 with which the optical fiber 921 located in flection 902a of a slot 902 was equipped, an angle of diffraction changes with those wavelength. Consequently, the lightwave signal of specific wavelength can be received by the specific part in the array photo detector 931 out of synchrotron orbital radiation 922, and it operates as an optical tap also in the time of wavelength multiplex transmission.
[0052] Although the slot 902 and the array photo detector 931 are drawn as it integrates, what was produced separately, of course may be installed in the position on a substrate 900. Other points are the same as the 6th example and the 9th example. The physical relationship of this example or an optical fiber 921, and a photo detector 931 is stabilized, consequently it operates as an optical tap with the fixed joint effectiveness of light also in the time of wavelength multiplex transmission.
[0053] (The 11th example) Drawing 11 is a drawing which expresses the description of the 11th example of this invention best, and the semiconductor laser which is signal light source with 1061 [another / the signal light source 1011], and 1062 are the laser light by which outgoing radiation was carried out from semiconductor laser 1061 in this drawing. The direction of this laser light 1062 meets in the direction in which the post-stage of flection 1021a of optical waveguide 1021 is extended in general. Other configurations are the same as the 1st example.
[0054] In this configuration, if a current is poured into semiconductor laser 1061, outgoing radiation of the laser light 1062 will be carried out. And it is combined with optical waveguide 1021 from the part in which the aperture of flection 1021a of optical waveguide 1021 was formed. Consequently, the ADD function of a lightwave signal is realized. In addition, two or more semiconductor laser with which wavelength differs instead of semiconductor laser 1011 may be used. Thus, this invention is applied also to the configuration which realizes the ADD function of a lightwave signal.
[0055] In the configuration of the 2nd example, the 3rd example, the 7th example, etc., similarly, another light source is arranged as mentioned above, and an ADD function may be realized.
[0056] (The 12th example) Drawing 12 is a drawing which expresses the description of the 12th example of this invention best. This example is an example which combined the configuration of the 1st example and the 11th example.
[0057] In this configuration, if a current is poured into semiconductor laser 1111, outgoing radiation of the laser light 1112 will be carried out, and it will carry out incidence to optical

waveguide 1121. By partial 1121a which has curvature among optical waveguides 1121, a part of laser light 1112 1122 which spread optical waveguide 1121 leaks out, and it is emitted. By receiving this laser light 1122 by the photo detector 1131, it operates as an optical tap.
[0058] The laser light 1162 emitted from another semiconductor laser 1161 on the other hand combines with optical waveguide 1121 from flection 1121a (it is the same as the part which a part of laser light 1112 1122 leaks mostly, and the aperture is formed here) of optical waveguide 1121. Consequently, an ADD function is realized. As mentioned above, in this example, an optical tap function and an ADD function are realizable for coincidence by the same flection 1121a.
[0059] In the 2nd example, the 3rd example, the 7th example, etc., similarly, the another light source and an another photo detector are arranged as mentioned above, and an ADD function may be realized.
[0060] (The 13th example) Drawing 13 is a drawing which expresses the description of the 13th example of this invention best. This example is an example which combined the configuration of the 11th example and the 5th example.
[0061] In this configuration, if a current is poured into semiconductor laser 1211, outgoing radiation of two or more laser light 1212 from which wavelength differs will be carried out, and they will carry out incidence to optical waveguide 1221. A part of laser light 1212 1222 which spread optical waveguide 1221 is emitted by partial 1221a which has curvature among optical waveguides 1221. By the diffraction grating 1251 with which optical waveguide 1221 equipped flection 1221a, as for this synchrotron orbital radiation 1222, an angle of diffraction changes with those wavelength. Consequently, the lightwave signal of the wavelength of specification [an array photo detector / 1231] can be received with the component of a specific part, and it operates as an optical tap also in the time of wavelength multiplex transmission.
[0062] the side face (since it diffracts and cannot introduce into optical waveguide 1221 from a side face with a diffraction grating 1251) (from -- it combines with optical waveguide 1221.) in which there is no laser light 1262 of 1251 diffraction grating of flection 1221a of optical waveguide 1221 emitted on the other hand from the semiconductor laser 1261 which is another light source Consequently, an ADD function is also realizable for coincidence.
[0063] In the 6th example, the 9th example, the 10th example, etc., similarly, semiconductor laser is arranged as mentioned above and an ADD function may be realized. In addition, light can be introduced all over an optical transmission line from a location as shown in drawing 13 also with a configuration without a diffraction grating.
[0064]
[Effect of the Invention] As explained above, even if it uses neither a directional coupler nor a phase shifter, according to the optical transmission device of this invention, an optical tap function is realizable by radiation mode existing by the flection among optical transmission lines, and receiving this light by the photo detector.
[0065] Moreover, similarly, according to the optical transmission device of this invention, the light emitted from the light emitting device can be combined with optical waveguide through the flection of optical waveguide, and an ADD function can be realized. Therefore, an optical tap function and an ADD function are also realizable for coincidence.
[0066] Moreover, if a configuration component is integrated, where the physical relationship of each component was stabilized, consequently the joint effectiveness of light is kept constant, an optical tap function or/and an ADD function are realizable.
[0067] Furthermore, an optical tap function is realizable also in the time of wavelength multiplex transmission establishing spectral separation thru/or the filter means of a diffraction grating, a wavelength selection optical filter, etc. between the flection, this flection, and photo detectors of an optical transmission line.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing explaining the optical transmission device concerning the 1st example of this invention.
[Drawing 2] It is the top view (a) and sectional view (b) explaining the optical transmission device concerning the 2nd example of this invention.
[Drawing 3] It is drawing explaining the optical transmission device concerning the 3rd example of this invention.
[Drawing 4] It is the top view (a) and sectional view (b) explaining the optical transmission device concerning the 4th example of this invention.
[Drawing 5] It is drawing explaining the optical transmission device concerning the 5th example of this invention.
[Drawing 6] It is drawing explaining the optical transmission device concerning the 6th example of this invention.
[Drawing 7] It is the top view (a) and sectional view (b) explaining the optical transmission device concerning the 7th example of this invention.
[Drawing 8] It is drawing explaining the optical transmission device concerning the 8th example of this invention.
[Drawing 9] It is drawing explaining the optical transmission device concerning the 9th example of this invention.
[Drawing 10] It is drawing explaining the optical transmission device concerning the 10th example of this invention.
[Drawing 11] It is drawing explaining the optical transmission device concerning the 11th example of this invention.
[Drawing 12] It is drawing explaining the optical transmission device concerning the 12th example of this invention.
[Drawing 13] It is drawing explaining the optical transmission device concerning the 13th example of this invention.
[Description of Notations]
11, 111, 211, 311, 411, 511, 611, 711, 811, 911, 1011, 1111, 1211 semiconductor laser
12, 112, 212, 312, 412, 512, 612, 712, 812, 912, 1012, 1112, 1212 laser light
21, 121, 221, 321, 421, 521, 621, 721, 821, 921, 1021, 1121, 1221 optical transmission lines (optical waveguide, optical fiber)
21a, 121a, 221a, 321a, 421a, 521a, 621a, 721a, 821a, 921a, 1021a, 1121a, 1221a Flection of an optical transmission line
22, 122, 222, 322, 422, 522, 622, 722, 822, 922, 1022, 1122, laser light that branched 1222 times
31, 131, 231, 331, 431, 531, 631, 731, 831, 931, 1131, 1231 Photo detector
100, 300, 500, 600,700,800,900 Common substrate
101, 301, 501, 601, 701, 801, 901 Embedding laminated structure
241, 341, 741 Wavelength selection optical filter
451, 551, 951, 1251 Diffraction grating formed in the flection of an optical transmission line
602, 702, 802, 902 Slot to which an optical transmission line is dedicated
602a, 702a, 802a, 902a Flection of a slot
851 Diffraction Grating Formed in Flection of Slot

1061, 1161, 1261 Another semiconductor laser
1062, 1162, 1262 Another laser light

[Translation done.]

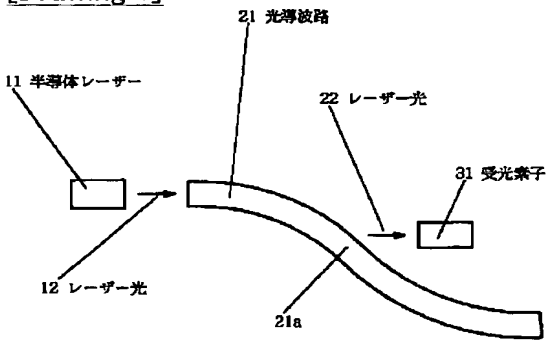
* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

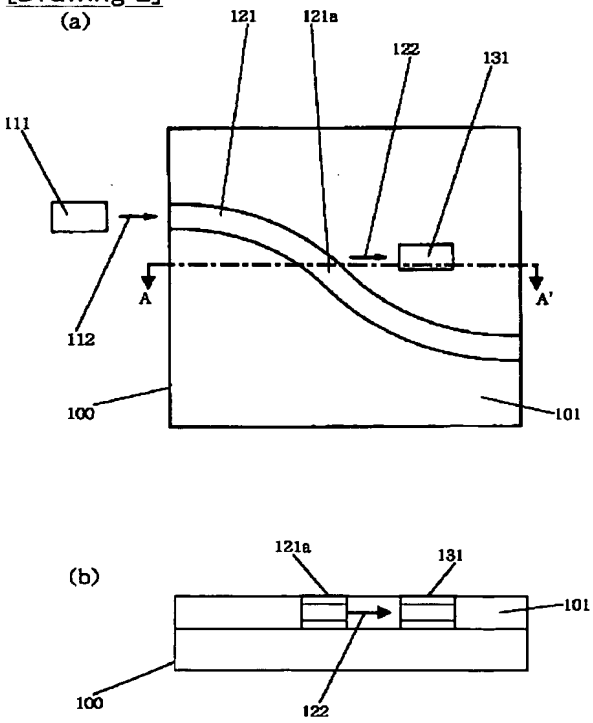
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

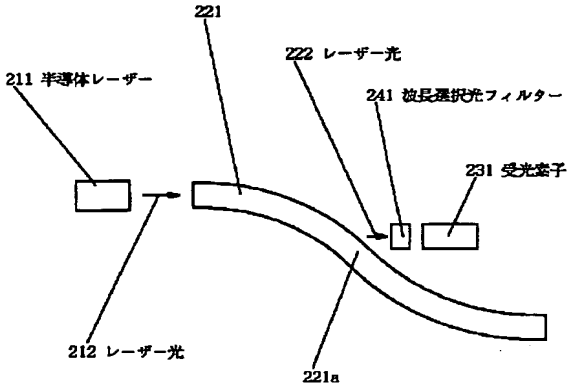
[Drawing 1]



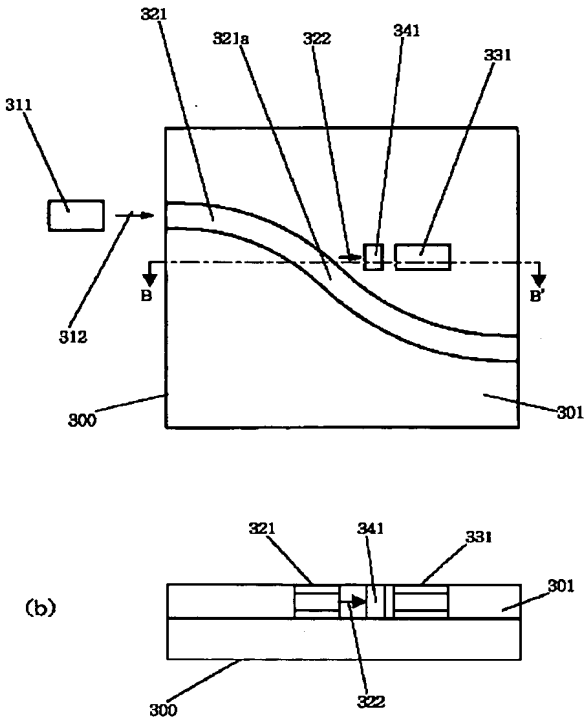
[Drawing 2]



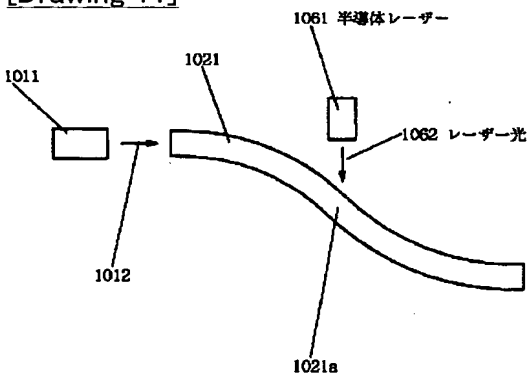
[Drawing 3]



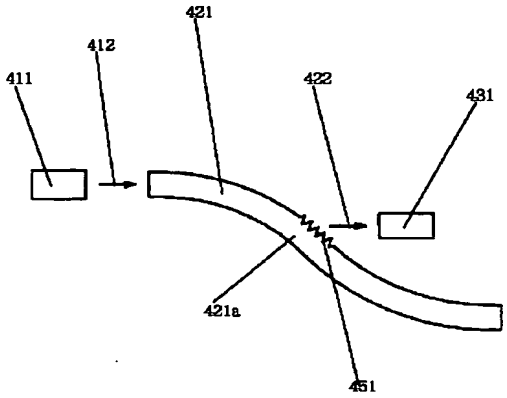
[Drawing 4]



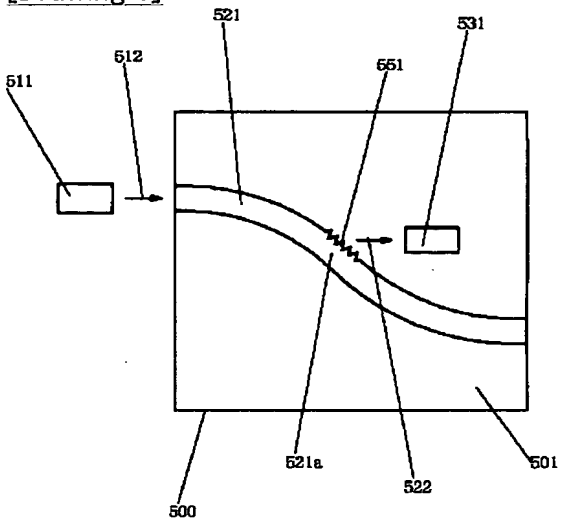
[Drawing 11]



[Drawing 5]

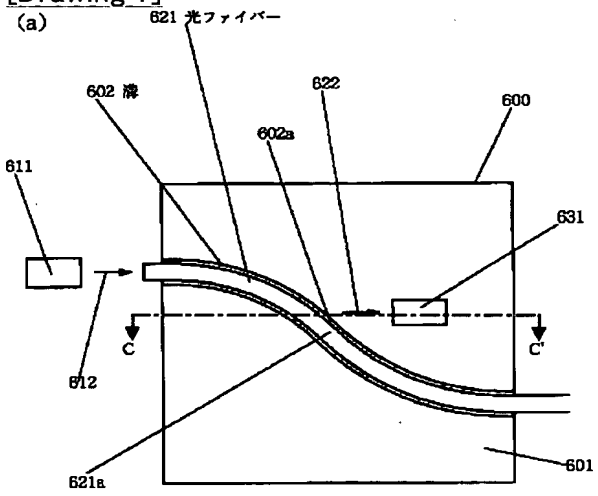


[Drawing 6]

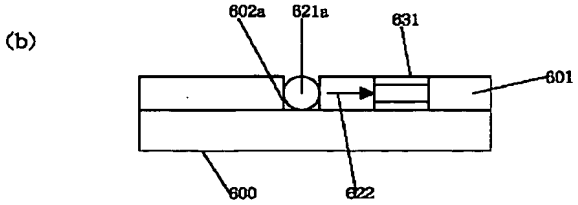


[Drawing 7]

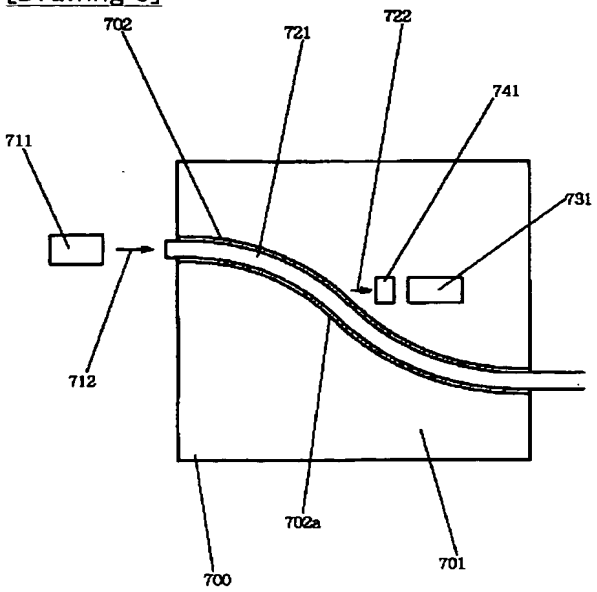
(a)



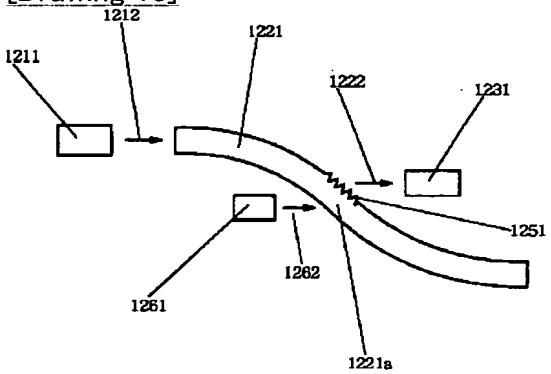
(b)



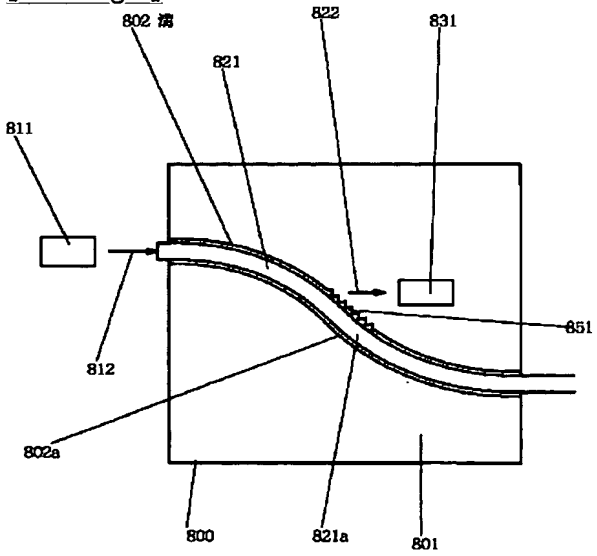
[Drawing 8]



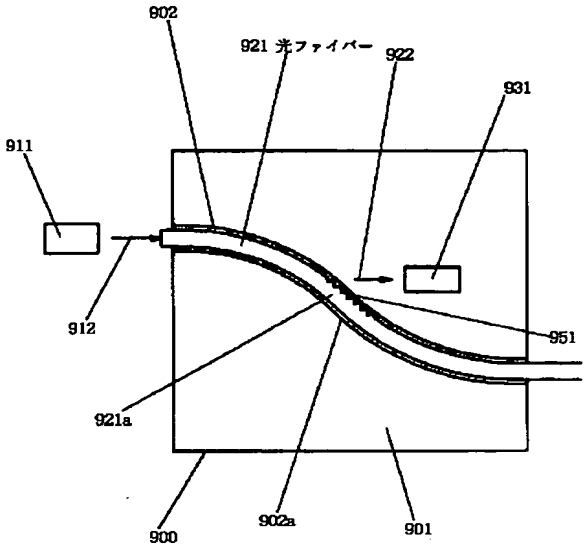
[Drawing 13]



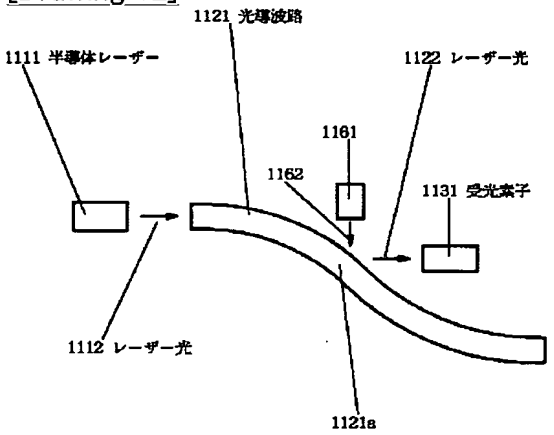
[Drawing 9]



[Drawing 10]



[Drawing 12]



[Translation done.]